Sounding objects

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Sounding objects | Les objets sonores

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Philosophical Theories of Sound

- Why are we proposing a 'philosophical' theory of sound? Usefulness of conceptual analysis – vs. definition; vs. theoretical characterization.
- A fruitful way to organize issues and taxonomies about the nature of sound deals with how theories conceive of the *spatial* properties of sounds.

Proximal theories

- According to *proximal* theories, sounds are sensations or qualitative aspects of auditory perception. From the point of view of proximal theories, sounds are conceived of as internal events, as mental episodes, or proximal stimulations. This may be the mainstream view in psychology. It emphasizes the high correlation between felt properties of sounds and properties of perceptual system.

Medial theories

- According to *medial* theories, sounds are conceived of as being located between the sounding objects and the hearer. This may be the mainstream view in acoustics: sounds are held to be *sound waves*. It has a high explanatory power due to the high correlation of physical quantities and felt qualities. However, the correlation is poor with felt location of sound.

Distal theories

- One should consider another candidate for the determination of the nature of sounds, namely *distal* properties, processes or events in the medium inside (or at the surface of) sounding physical objects, or in the stuff of the sounding object. Distal views claim they are superior to their non-distal competitors in virtue of their better adherence to the *spatial* structure of auditory content. In point of fact, we do hear sounds both as *externalized* (hence auditory content is at odds with proximal views) and as *distally located* (hence auditory content is at odds with medial views).
- Sounds are *where* you hear them. A possible misreading of the phenomenological constraint: "we want an account of sounds that is completely true to the phenomenology" – this is a much too strong reading. A weaker construal is this: auditory perception has the power to represent sounds; it has the power to represent motion; it has the power to represent sounds in motion; hence it should be able to represent *sounds as moving individuals*. But this is not possible according to medial theories (since sound waves are not moving individuals). Thus, medial theories are not convincing from the phenomenological viewpoint – and hence move to distal theories.

A distal theory: The Located Event Theory (LET) of sound

- According to the LET (Casati and Dokic, 1994, forthcoming; Casati, Dokic, Bullot & Giri, in preparation), sounds are located events happening to *sounding objects*[1]. Typically, each particular sound is a vibratory event/process occurring in the stuff of a resonating material/physical object.
- Examples of LET classifications on the basis of particular audio recordings:
- Example A,[2] *Object-fall in a courtyard*, one can perceive the located *event* of the fall affecting a individual *sounding object* (that has undergone this event) and obtain information about its spatial context (reverberations or echoes due to surrounding walls, atmospheric surrounding events, background noises).
- Example B, *Footsteps*, main sounding object: a person (walking), an intentional agent; type of event: footfall, contact at regular intervals between the shoes and the ground surface, walking, heading toward something.
- Example C,[3] *Drawers*, a person is interacting with drawers and objects in them. This person is searching for objects in drawers and over a desk (opening drawers and moving sounding objects within them).
- Example D,[4] *Grasshoppers*, soundscape or landscape at night with grasshoppers or crickets; each insect is a particular sounding object.
- The LET includes an ontological and an epistemological analysis.

Ontology of sound according to the Located Event Theory

- According to the ontological analysis of the LET, sounds are *dependent individuals*: they depend on the existence of resonating physical objects (such as speakers, artifacts, animals, plants etc.). Sounds are *located at their physical source*, and may be identical with, or at least supervenient on, vibration processes in it. The location of sound is thus *parasitic upon* the location of the sounding object. Auditory perception of sounds requires a medium which transmits information from the vibrating object to the ears (air, water); however, the transmitting medium is not essential to the existence of sounds.
- We see at once the fit of this view with those features of sound which are sources of trouble in the cases discussed above. Vibration processes in the sounding object do not move any more than sounds appear to move. Like sounds, and unlike acoustic waves in the ambient medium, their intensity can remain the same through a period of time. Finally, and most importantly, tuning-forks and other sounding objects can be taken as continuing to vibrate irrespective of their being or not being immersed in a medium. We do not create sounds by surrounding vibrating objects with a medium – we simply *reveal* the vibrating event they are informing us about.
- A side-effect of the LET is that it makes plain what category sounds belong to, as opposed to views that construe sounds generically as qualities (e.g. as per traditional theories of secondary qualities). Sounds are either *instantaneous events* or *temporally extended processes*. They start and cease. They are intrinsically temporal entities.
- An interesting consequence of the strong version of LET ontology: sounds may exist in a vacuum (where a sounding/resonating object is). This is an apparent violation of the phenomenological constraint. The Quick Vacuum Jar Thought Experiment.
- Example A,[5] Tunnel effect with the glass bell-jar experiment: revealing the environmental sounds after enclosure of microphone within a glass bell-jar.

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[1] The notion of 'sounding object' is a technical term introduced in the framework of the LET. It refers to a particular physical object (or resonating object) in which a perceptible vibratory event takes. Its meaning is illustrated in the following paragraphs.

[2] Hear at http://nicolas-bullot.org/njbCOLL/SAO/AuditoryQueries/Object-fall_in-courtyard_August-12-2004_32-44.MP3.

[3] Hear at http://nicolas-bullot.org/njbCOLL/SAO/AuditoryQueries/ijn2_correct_bureau_rob_2.MP3.

[4] Hear at http://nicolas-bullot.org/njbCOLL/SAO/AuditoryQueries/grasshoppers.MP3.

[5] Hear at http://nicolas-bullot.org/njbCOLL/SAO/AuditoryQueries/glass-bell-experiment-and-storm_1.MP3.

Epistemology of the perception and cognition of sounding objects

- According to the epistemological analysis of the LET, in ordinary crossmodal perceptual experience, sounds usually can be directly (1) localized ('Where?') and (2) identified ('What?').
- (1) The perceptual *localization* of sounds; examples of auditory localization without (simple) identification of the sounding objects; case of the domination of localization information:
- Example A,[6] *Rotating object*, A sounding object, which is rotating on a resonating surface, has been captured via close-miking recording. Even though the spatial information is very well structured, the identification is problematic except perhaps for perceptual experts of the kind of physical object that has been used (one bass tabla with goat skin and a thick steel wire).
- Example B,[7] *Reverberated frictions*, impression of space without simple identification (microphones are inside a ruined piano, a rusted cord is rubbed by a metallic chain).
- (2) The perceptual *identification* of sounds relies on the perceptual recognition of the type of resonating object, the type of occurring event, or the spatio-temporal tracking of particular sounding objects. Sound perception contributes to crossmodal spatio-temporal tracking and identification (e.g., Driver & Spence 2004).
- Example A, *Speaker recognition*, recognizing the present speaker via the recognition of his particular voice is an ordinary example of identification of an individual sounding object.
- Example B, *Fast proto-identification of voice fragments*, serial composition of successive voice samples lasting no more than 500 milliseconds each: it should be salient that we can get identifying information from all of these tiny successive pieces, even though the obtained information does not guarantee identification in the strongest sense, i.e. demonstrative re-identification of a single individual across time (Strawson 1959, Evans 1982).
- Examples C,[8] *Influence of identifying information on localization (bells)*, a recording of church bells is projected at the ground level; if the sound image of the church bell were mislocated, this might be due to the long time perceptual learning of chiming from the top of churches instead of down at the ground level. In other terms, the way one perceptually locates these church bell sounds may be biased by your background semantic knowledge about the location of ordinary chuch bells. This might illustrate the possibility of influencing auditory localization by identifying (semantic) information. (At the very least, it is known that localization is influenced by crossmodal interactions, e.g. visual information can influence auditory location via crossmodal effects such as the ventriloquist illusion.)
- Example D, *Influence of identifying information on localization (footfalls)*, similar effects might be obtained with the recording of footfalls sounds projected by the ceiling (or eventually previous drawer sounds projected toward the ceiling).

Auditory images according to the LET

- According to the LET, audio recordings are generating the experience of *auditory images* (based on the emission of the loudspeakers, which are the only actual and accessible sounding objects when hearing auditory images).
- Electroacoustic mixing allows manipulating auditory images, as it has been done for years in the history of electroacoustic music, concrete music and acoustic installations. The manipulation of sound images is crucial for sound design because it relates to *meaningful perception* (Dretske 1995), via namely the manipulation of accessing and recognitional routines of auditory attention.
- Mixing audio recordings can lead to the production of 'physically impossible' or 'apparently illusory' auditory images:

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[6] Hear at http://nicolas-bullot.org/njbCOLL/SAO/AuditoryQueries/TablaLOOP2_circle1_4432.MP3 and http://nicolas-bullot.org/njbCOLL/SAO/AuditoryQueries/TBL%20LOOP%201.MP3 .

[7] Hear at http://nicolas-bullot.org/njbCOLL/SAO/AuditoryQueries/Ruind-pia_(Macon-1999)_chain-rub_32-48.MP3 .

[8] Hear at http://nicolas-bullot.org/njbCOLL/SAO/AuditoryQueries/royaumont_bell_32-48b.MP3 .

- Example A,[9] This mixing is based on the idea of making 'intersecting' at 'approximately the same location' the sound image of a process of combustion (fire obtained via gaz combustion) and a process of water churning (moving a wire in water).
- Example B,[10] This mixing proceeds by superposing four stereophonic bikes images focused on rotating wheels (with one stick in their spokes).
- Example C,[11] This mixing proceeds with miscellaneous sounding objects of *different kinds*.

Conceptual revisions entailed by distal theories and the LET

- How much should our conception of sound be revised?
- A fundamental ambiguity affects the notion of 'sound-object'. On the one hand, a 'sound-object' is merely a physical object that produces a sound, a distal *sounding object*; on the other hand, the 'sound-object' is the sound itself, what I have an auditory experience of. The conceptual shift is quite common in ordinary parlance: hearing a car is hearing the sound of the car, and conversely. The LET firmly anchors the sound in the resonating object – the sounding object.
- By 'object' in 'sounding object' we *do* mean 'particular physical body' that fulfills objecthood criteria (such as possessing spatio-temporal continuity and causal powers). We do *not* mean 'objets sonores' in Schaeffer's sense (e.g., Schaeffer 1966, Schaeffer & Reibel 1998[1967]: 52-66). The latter are not localized in a physical mind-independent body but (apparently) are narrow intentional contents of auditory attention or 'reduced hearing' – or sound images. The identity/objectivity criteria of Shaeffer's 'objets sonores' is more problematic than those of LET's sounding objects.
- Potential consequences of reconceptualization: Object Oriented Musical Composition (instead of tone-oriented or relation-oriented composition) should take into account the perceptual abilities for recognizing ordinary sounding objects. Sound designers should develop Object Oriented Auditory Interfaces.

Replies to objections

- We shall now briefly discuss some interrelated objections to the identification proposed by the Location Event Theory.
- (1) *Imprecise location.* The first objection concerns sound location. We suggested that sounds are heard as located, but it could be maintained that the location is often imprecise or even erroneous, this in turn depending on the nature of sounds waves. If a sound wave coming from a sounding object located on my right is reflected by a wall on my left, a sound is heard as being located on my left. But we see no particular problem in this fact, as in other facts linked to misperception. Seeing an object in the mirror is not seeing another, immaterial object located in an immaterial space beyond the mirror-plane. There is no such object; we see one and the sole material object, and we locate it incorrectly.
- Example A,[12] *Multiple individual grasshoppers*: Distinct recordings of clouds of crickets and grasshoppers: Apparent objection to the theory: the overall experience is that of an overall and surrounding sound (then un-located); reply to the objection: just move and get closer to one particular sounding object/individual (cf. phonotaxie); recordings: instance 1 = filtered (no salient individual), instance 2: non filtered (salient individual).
- Example B,[13] *Located droplets*: The same kind of considerations may apply here too, excerpt that rain droplets are too small and ephemeral to be tracked individually by human perceptual systems (i.e., without prosthetic apparatuses).
- The temptation of identifying sounds with sound waves can arise because of precisely this fact: that sounds can be mislocated. They can be heard as located in a region which is larger than the one occupied

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[9] Hear at http://nicolas-bullot.org/njbCOLL/SAO/AuditoryQueries/Wet-fire1_ELEMden_v7_3296.MP3 and http://nicolas-bullot.org/njbCOLL/SAO/AuditoryQueries/Wet-fire(mousse)1_ELEMden_v7_3296.MP3 .

[10] Hear at http://nicolas-bullot.org/njbCOLL/SAO/AuditoryQueries/bikes_ELMTv7.MP3 .

[11] Hear at http://nicolas-bullot.org/njbCOLL/SAO/AuditoryQueries/Mix-dic_1_ELEMden_v7_3296.MP3 .

[12] Hear at http://nicolas-bullot.org/njbCOLL/SAO/AuditoryQueries/grasshoppers.MP3 .

[13] Hear at http://nicolas-bullot.org/njbCOLL/SAO/AuditoryQueries/Rainfall_Granularity_MedQ_.MP3 .

by a sounding object, a region which it is reasonable to take as being occupied by sound waves. But does this compel us to accept the identification of sounds with sound waves? By no means. Sound waves are responsible for the perceptual difficulty in locating sounds, as mirrors are for the analogous difficulty for visible objects. But it is not the case that sound waves are sounds just because of this responsibility. Consider the following sophism: *x* hears something as imperfectly located, therefore *x* hears something which is imperfectly located. This would be an invalid inference from epistemology to ontology.

- (2) *Doppler Effect.* The second objection concerns typical acoustic effects, like the Doppler effect, which are perfectly accounted for by appeal to medial sound waves. Such explanations of the Doppler effect are harmless for our own account. The Doppler effect is dependent on something going on in the medium, but this should not make us think that what we hear are sound waves. When we hear sounds as undergoing a Doppler effect, we do not hear anything different from a vibration process in a sounding object, a process which is heard in a sort of perspectival shortening because the movement of the sounding object causes, among other things, the Doppler effect.
- (3) *The causal link.* Another objection has it that surely there are sound-waves in the ambient medium, otherwise no causal link could be set between the sounding object and our perception of the latter. And such sound waves can certainly be measured and physically described. Now we dare not deny that there are sound waves in the ambient medium: of course there are, and they are causally responsible for our aural perceptions when these are perceptions of anything at all. We just contend that such sound waves are not what we hear – in this sense, they are not perceptual deputies, for we do not perceive sounds by perceiving them. Consider an analogy. Light is causally responsible for your perception of an object's surface. But this does not make you see the light. Actually, we can see light-emitting sources, but never light in itself: in order to be seen, light should have to emit light carrying information about it.

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